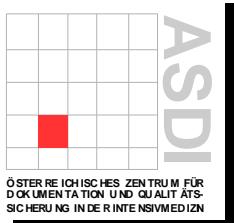


Qualität aus der Sicht des Intensivmediziners – facts and fiction

Andreas Valentin

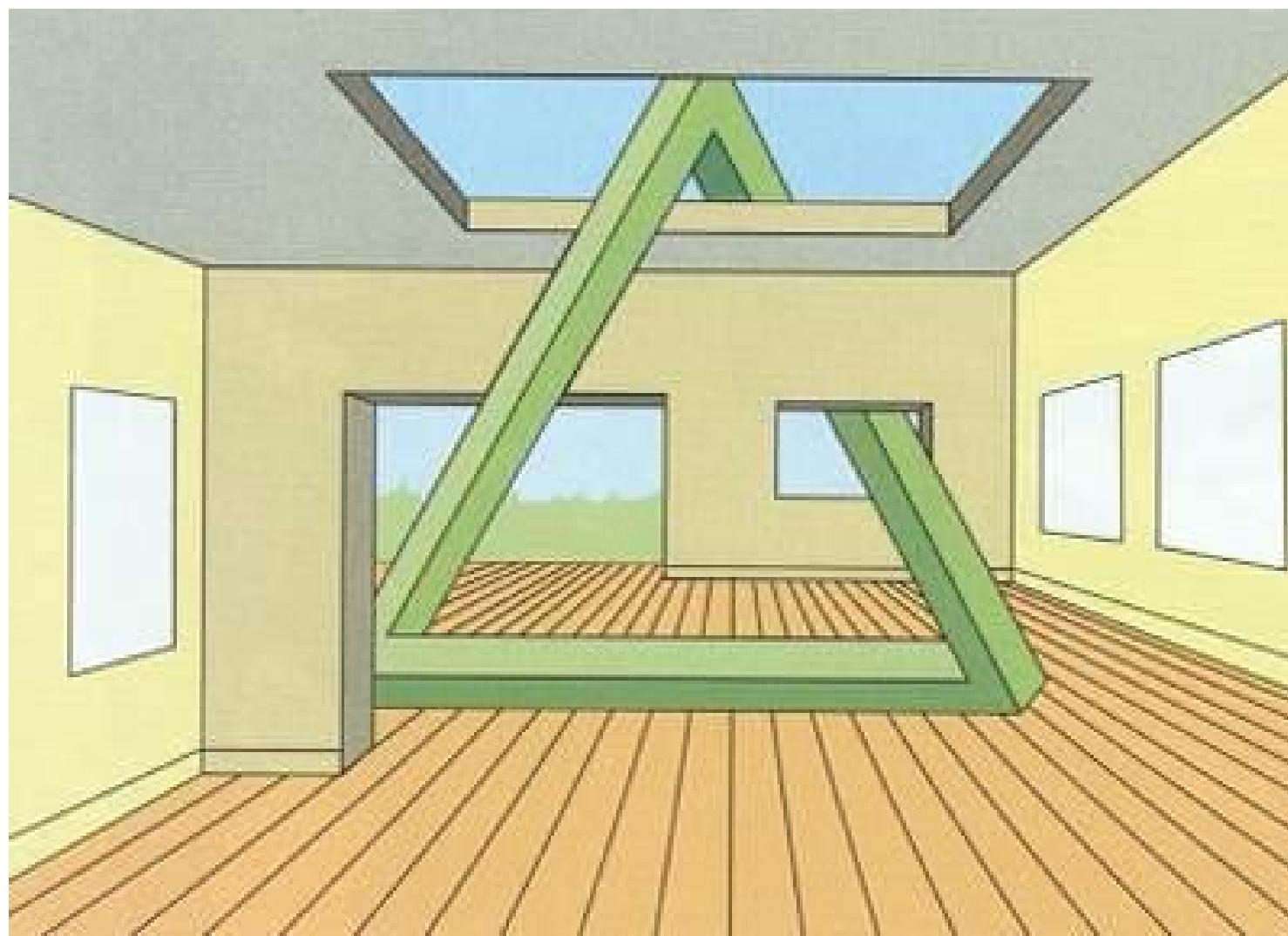
Allgemeine u. Internistische Intensivstation 12A

II. Med. Abt., KA Rudolfstiftung, Wien

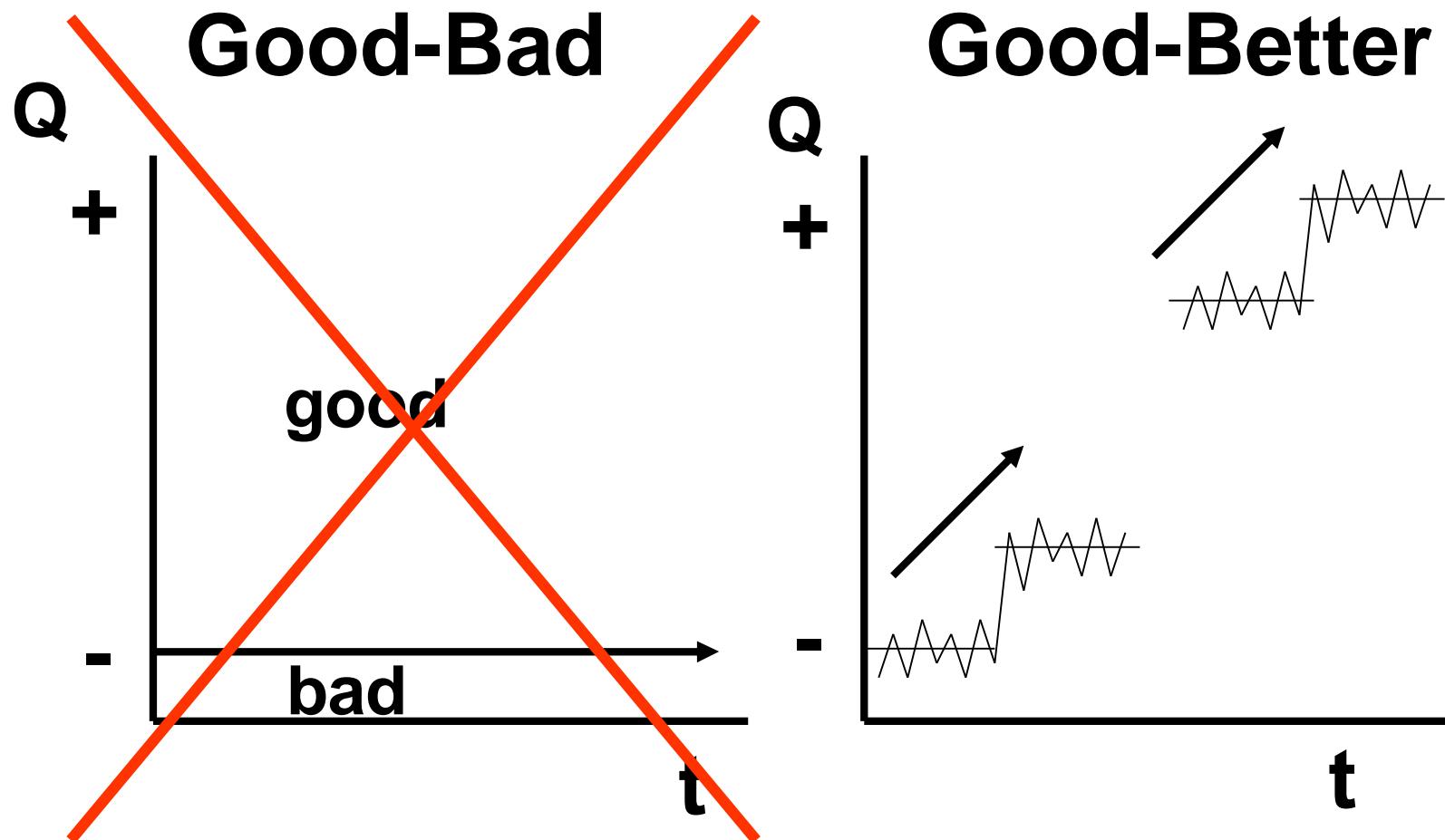


andreas.valentin@wienkav.at





Paradigm of Quality



What is Quality ?

“the degree to which health services increase the likelihood of **desired health outcomes** and are consistent with current professional knowledge”

Institute of Medicine, 1990

Quality = Results
Objectives

Quality Indicators

Eingrenzung und Funktion von Qualitätsindikatoren

Qualität ist

- über Ziele definiert
- eine Frage der Perspektive

Qualitätsindikatoren

- geben Zielbereiche vor
- ermöglichen Monitoring
- legen einen Anspruch fest

TRAUM UND WIRKLICHKEIT



Wien – Künstlerhaus – 1985

Quality Indicator Domains

- **Structure**
what you need vs what is provided
- **Process**
what you should do vs. what you do
- **Outcome**
what you expect vs. what you find

Raumstruktur Intensivstation

Normalflächenbedarf für ICU Betten

Empfehlungen der European Society of Intensive Care Medicine

- Patienten Einzelzimmer pro Bett 25m²
 - Patienten Mehrbettzimmer pro Bett 20m²
 - Lager pro Bett 10m²
 - Nebenräume pro Bett 33m²
- } Pro Bett
63-68m²
- Büros
 - Dienstzimmer
 - Labor
 - Technik
 - Besprechung
 - Angehörige
 - Sozialraum, Küche

Quality interactions in nosocomial infection

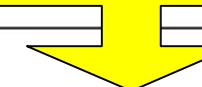
- Structure
 - Room design
 - Fixed installations
 - Medical equipment
 - Air conditioning
 - Staffing
 - Training level
 - funding
- Process
 - Handwashing
 - Isolation/infection precaution
 - Infection reporting
 - Room cleaning, disinfection
 - Antibiotic use
 - Communication

Availability of an alcohol solution can improve hand disinfection compliance in an intensive care unit

Maury E, AJRCCM 2000

	P1 % (no. of opportunities observed)	P2 % (no. of opportunities observed)	p Value
All health care workers General observance	42.4 (621)	60.9 (905)	0.0001
Personal gestures	56.5 (46)	49.2 (132)	0.4
Care without exposure to patient fluids	38.9 (445)	63.4 (587)	0.001
Care with exposure to patient fluids	49.2 (130)	61.3 (186)	0.03

Alcohol solution
easily available

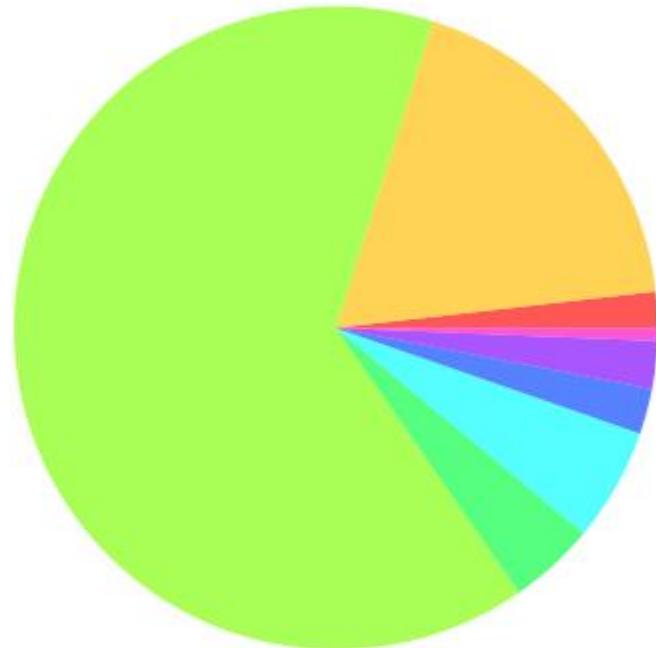


4 months later: 51.3 %

Schema Intensivaufenthalt

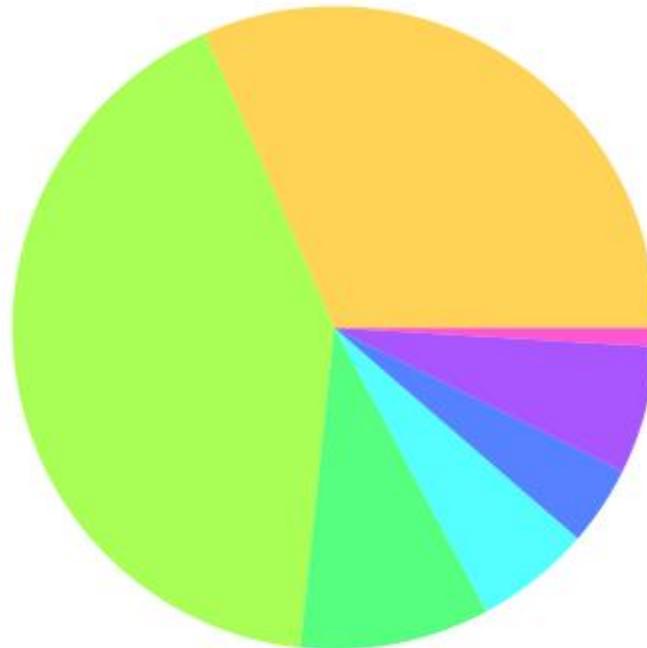
Merkmale	<i>Wer</i> <i>Wann</i> <i>Wo</i>	<i>Was</i> <i>Wann</i> <i>Wie lange</i>	<i>Wer</i> <i>Wann</i> <i>Wohin</i>
Phase	Aufnahme	Behandlung	Entlassung
Struktur	+	+	+
Prozess	+	++	+
Ergebnis	+	+	++

**Herkunft
Kollektiv: Gesamt**



Unbekannt	1.8 %
Von zuhause	18.3 %
Von eigenem KH	64.5 %
Von anderem KH	4.3 %
Von Öffentlichkeit	5.7 %
Von IBS aus eigenem KH	2.3 %
Von IBS aus anderem KH	2.4 %
Von Pflegeheim	0.6 %

**Herkunft
Kollektiv: IBS**



Unbekannt	0.0 %
Von zuhause	31.6 %
Von eigenem KH	41.7 %
Von anderem KH	9.5 %
Von Öffentlichkeit	5.8 %
Von IBS aus eigenem KH	4.0 %
Von IBS aus anderem KH	6.4 %
Von Pflegeheim	0.9 %

Confidential inquiry into quality of care before admission to intensive care

McQuillan, BMJ 1999

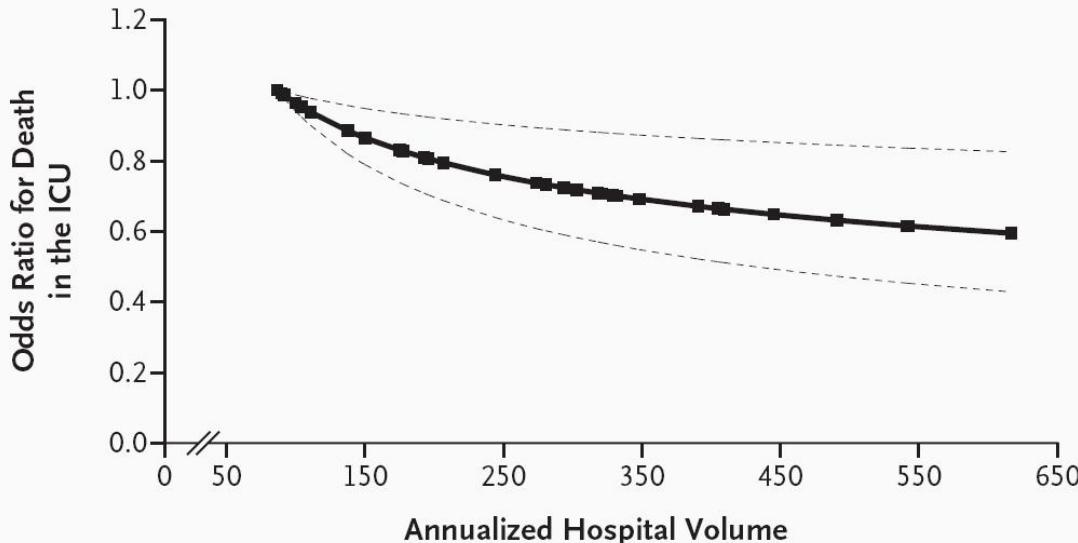
100 Patienten – retrospektive Beurteilung durch 2 Reviewer

- **Suboptimale Behandlung vor ICU-Aufnahme:** 56%
- **Verspätete ICU-Aufnahme:** 39%
- **ICU Aufnahme bei optimaler Versorgung vermeidbar:** 4 - 41%
- **Morbidität / Mortalität durch suboptimale Behandlung beeinflusst:** 32%

Hospital volume and the outcomes of mechanical ventilation.

Kahn JM, NEJM 2006

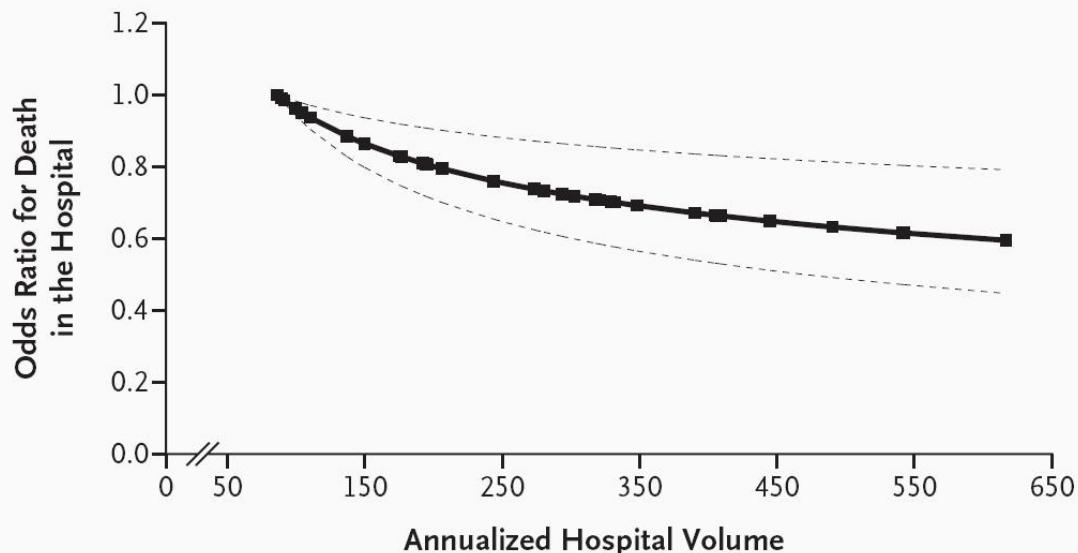
A



ICU mortality
reduction

pts/yr
87-150
151-275
276-400
401-617

B



Hospital mortality
reduction

pts/yr
87-150
151-275
276-400
401-617

Patient volume affects outcome in critically ill patients

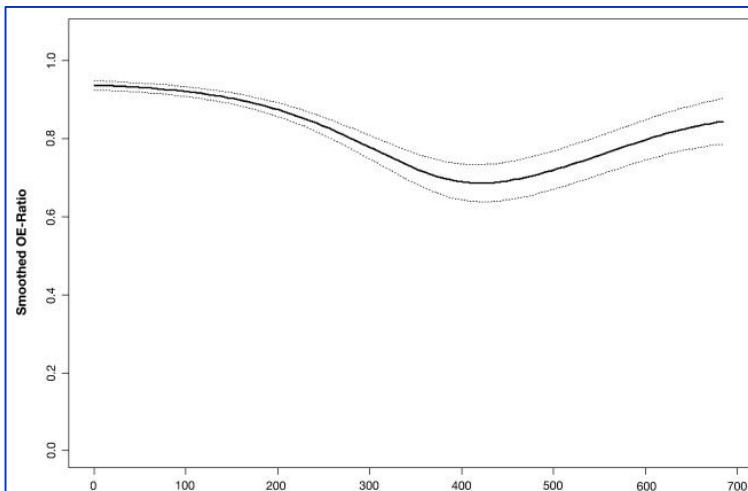
Barbara Metnitz¹, Philipp G.H. Metnitz², Peter Bauer¹, Andreas Valentin³, on behalf of the ASDI Study Group

¹Department of Medical Statistics, Medical University of Vienna, Vienna, Austria

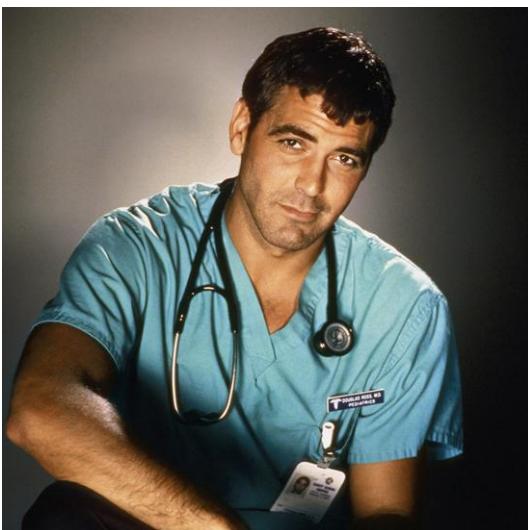
²Department of Anesthesiology and General Intensive Care, Medical University of Vienna, Vienna, Austria

³Department Internal Medicine, KH Rudolfstiftung, Vienna, Austria

Variable	Unit	Odds ratio	95% CI	
Patients per year per ICU bed	10	0.960	0.946–0.974	–
Patients in the same diagnostic category	10	0.995	0.993–0.997	–
Patient-to-nurse ratio (care days)	1	1.296	1.207–1.391	+



Personal: Gibt es Dosiseffekte ?



The effect of prompt physician visits on intensive care unit mortality and cost

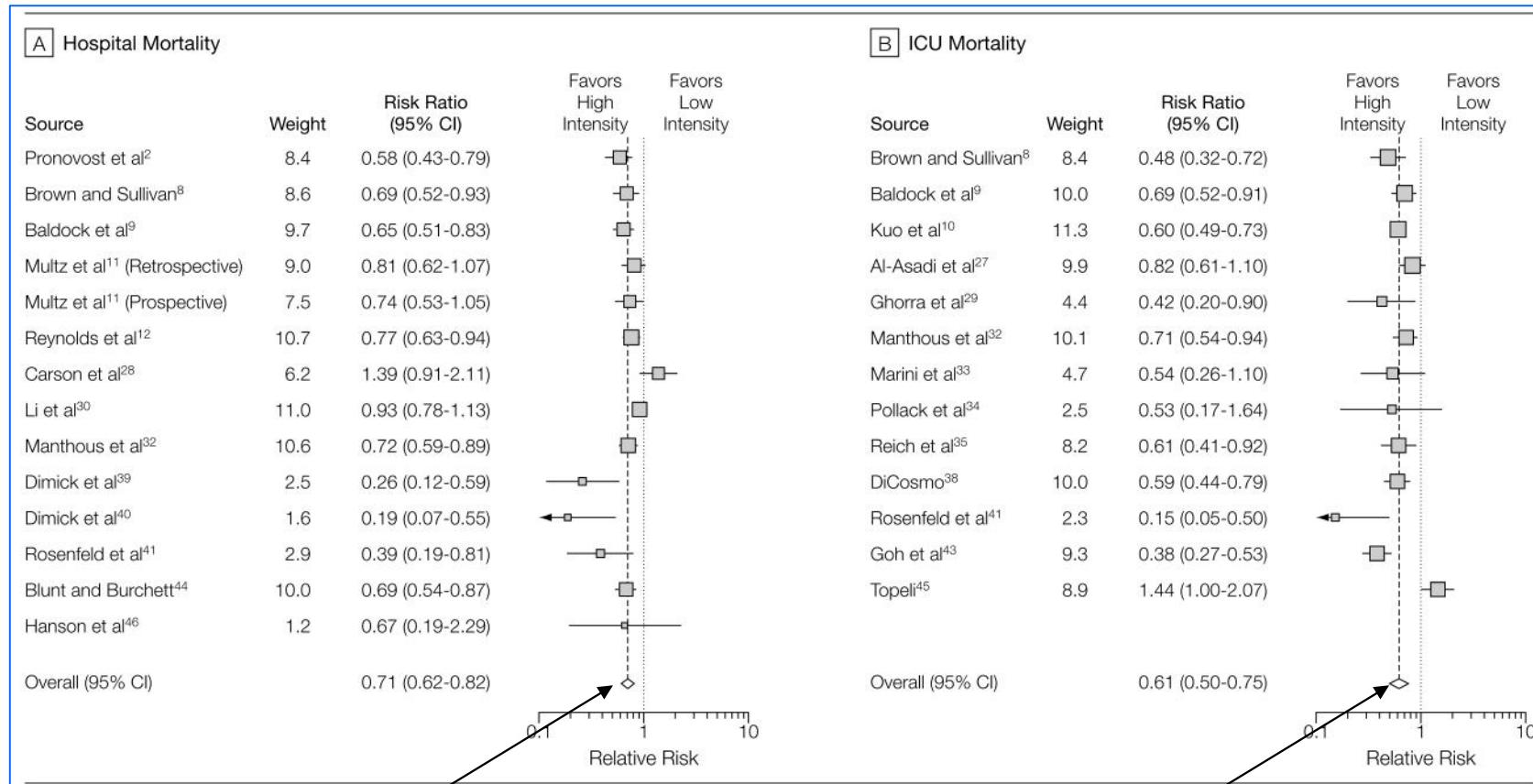
Factor	Exp(B)	p Value	95% CI for Exp(B)
APACHE ₀	1.052	<.001	1.040–1.063
Age	1.015	.013	1.003–1.027
Ventilation on ICU admission	1.567	.023	1.065–2.307
Time until seen	1.016	.040	1.002–1.030

Risk of hospital death

- Each 1 hour delay 1.6% increased

Engoren M, Crit Care Med 2005

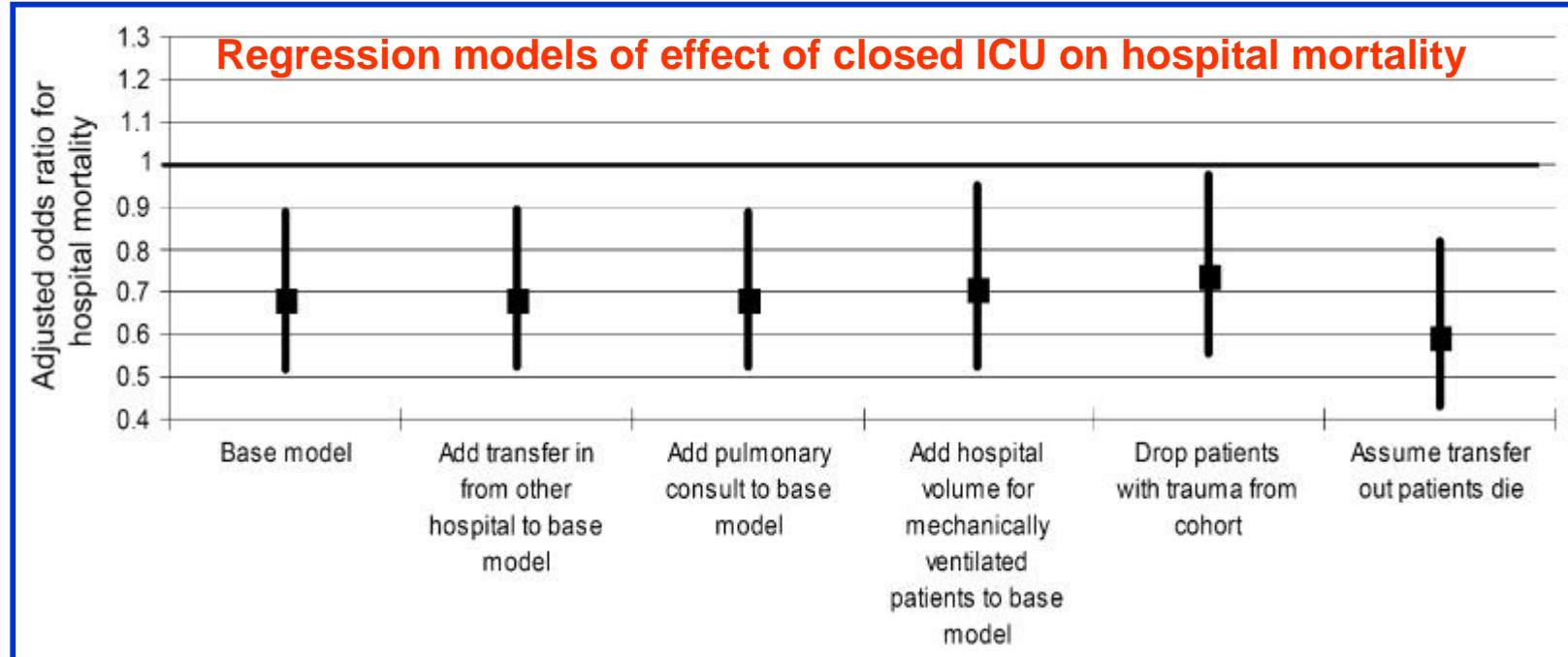
High-intensity vs low-intensity ICU physician staffing is associated with reduced hospital and ICU mortality



Hospital mortality
0.71 (0.62-0.82)

ICU mortality
0.61 (0.50-0.75)

Pts with ALI: Open versus closed ICU model



	Open ICU	Closed ICU	p
Intensivist coverage, mean h/d			
Weekdays	5.5±1.2	8.9 ±1.2	0.07
Weekends	5.1±1.0	6.9 ±1.0	0.05
Tidal volume on day 3 of ALI > 12ml/kg	31%	10%	<0.001

Errors detected and recovered during 10-h of ICU practice

Subject	Error detection	Recovery	Mean time per error
Expert	18	15	0.4
Resident	13	8	1.5
Student	8	2	3.0

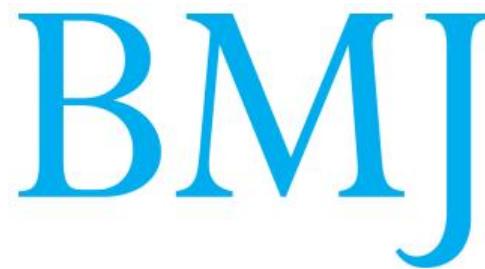
Patel VL, Curr Opin Crit Care 2008

Effect of Reducing Interns' Work Hours on Serious Medical Errors in Intensive Care Units

CP Landrigan et al, NEJM 2004

	Traditional	Intervention
Average hours/week	77-81	60-63
Consecutive hours	up to 34	16
Patient days	1294	909
Errors/1000 pt days	136	100

- 26%



Errors in administration of parenteral drugs in intensive care units: multinational prospective study

Andreas Valentin, Maurizia Capuzzo, Bertrand Guidet, Rui Moreno, Barbara Metnitz, Peter Bauer, Philipp Metnitz and on behalf of the Research Group on Quality Improvement of the European Society of Intensive Care Medicine (ESICM) and the Sentinel Events Evaluation (SEE) Study Investigators

BMJ 2009;338;b814
doi:10.1136/bmj.b814

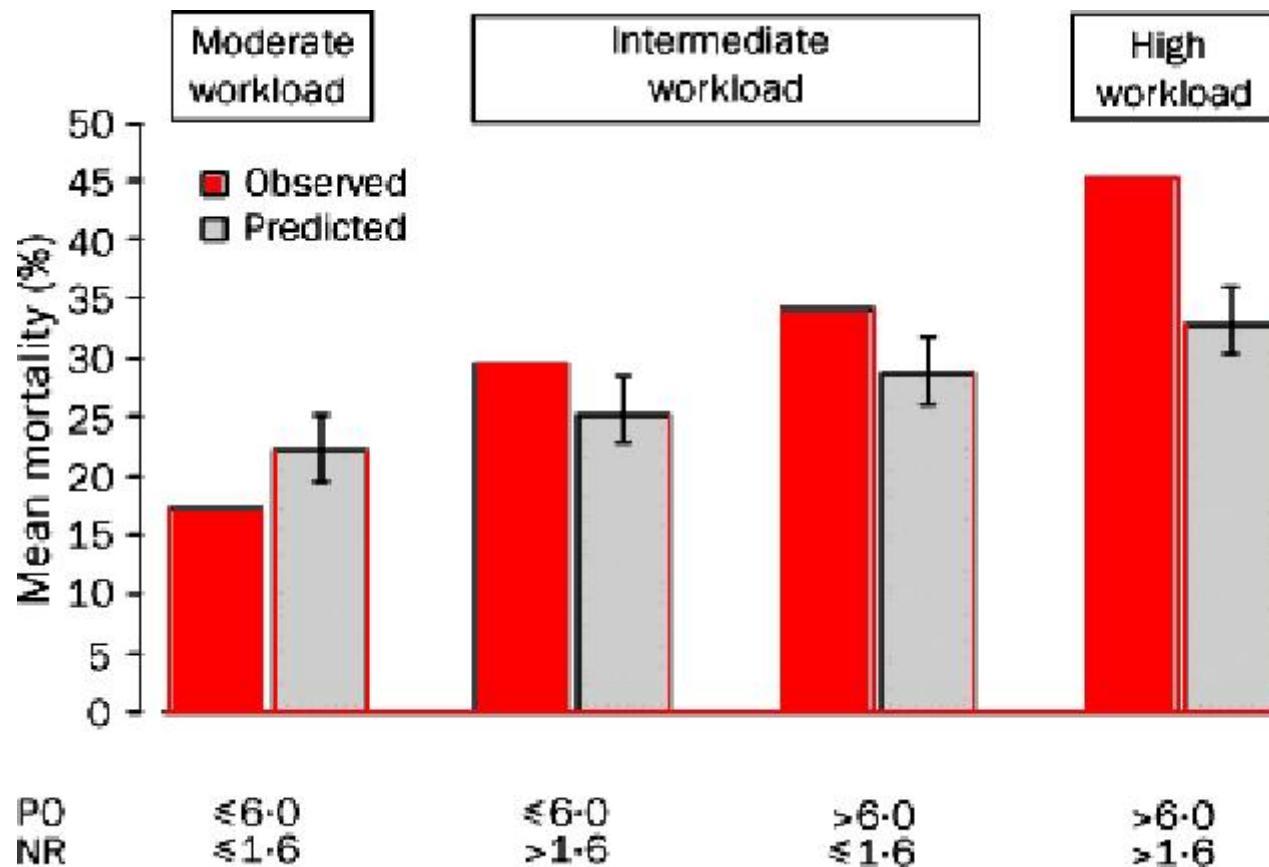
Errors of commission (wrong dose, wrong drug, wrong route)

Hospital size (beds)	100	1.05 (1.02 to 1.08)	<0.01
ICU size (beds)	1	1.02 (1.01 to 1.03)	<0.01
Patients per nurse	1	1.51 (1.10 to 2.07)	0.01
Patients per physician	1	1.10 (1.01 to 1.20)	0.03
ICU beds per nurse	1	1.35 (1.02 to 1.77)	0.03
CIRSt in place	Yes/no	0.36 (0.24 to 0.54)	<0.01
Infusions previously prepared by pharmacist	Yes/no	2.32 (1.57 to 3.41)	<0.01
Electronic prescribing system in use	Yes/no	0.62 (0.40 to 0.95)	0.03

OR for at least one error in parenteral drug administration in ICU. Univariate logistic regression

Einfluss des Personalaufwandes (Pflegepersonal) auf den Outcome von Intensivpatienten

Tarnow-Mordi WO, Lancet 2000



Höhere Arbeitsbelastung ist mit erhöhter KH Mortalität assoziiert (OR 3.1; 95% CI 1.9-5.0)

Schema Intensivaufenthalt

Merkmale

*Was
Wann
Wie lange*

Phase

Aufnahme Behandlung Entlassung

Struktur

+

+

+

Prozess

+

++

+

Ergebnis

+

+

++

Possible ICU quality indicators (1)

- Process
 - DVT prophylaxis
 - Stress ulcer prophylaxis
 - VAP prevention strategies
 - CVC bloodstream infection prevention strategies
 - Protocol driven ventilator weaning
 - Treatment in severe sepsis

Possible ICU quality indicators (2)

- Process
 - Low tidal volume in ALI/ARDS
 - NIV for hypercarbic respiratory failure
 - Early enteral feeding
 - Appropriate transfusion threshold
 - Delayed transfer out of ICU
 - Palliative care

Interventions to reduce mortality among ICU pts

	% of pts not receiving therapy
• High intensity ICU physician staffing	63-90
• Steroids in sepsis	15-85
• Tight glucose control	70-80
• Low tidal volume in ARDS	50-90

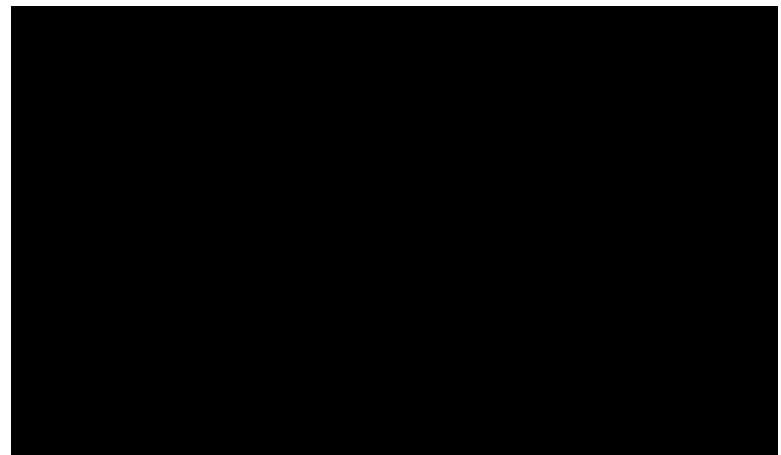
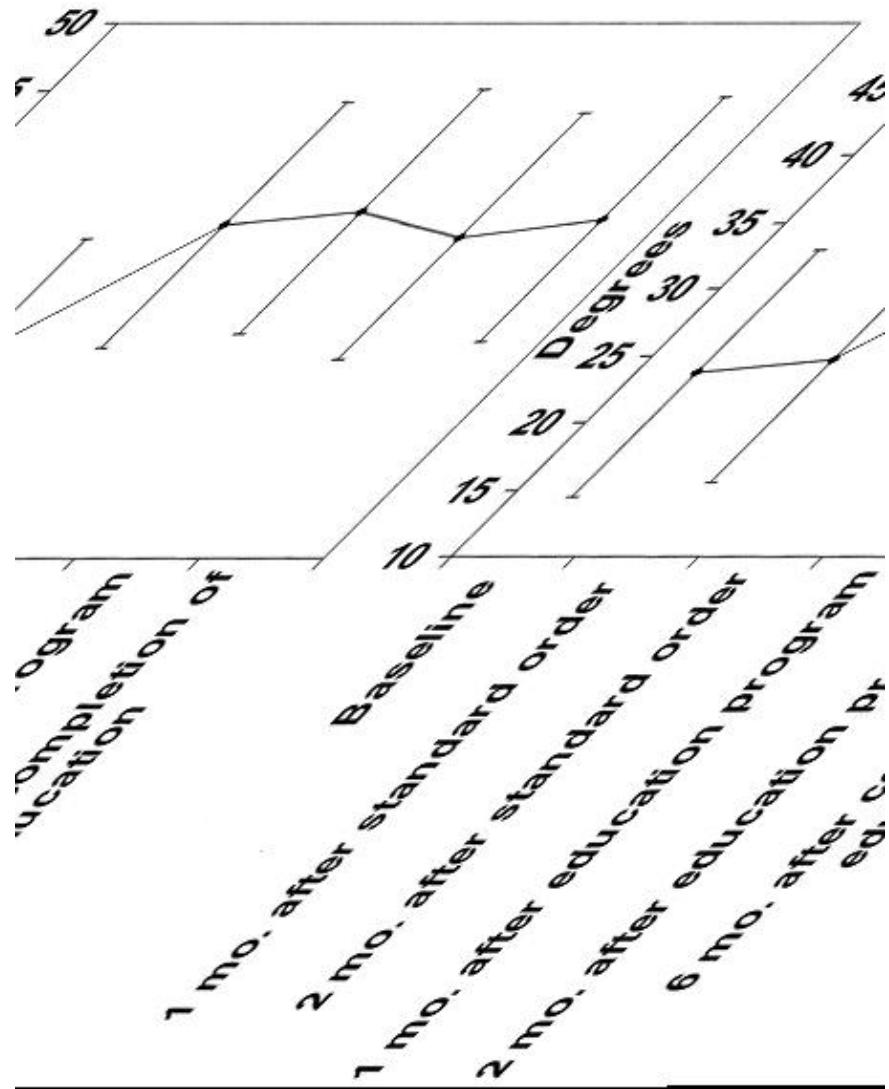
Process of care



Pronovost PJ, J Crit Care 2004

Effect of standardized orders and provider education on head-of-bed positioning in mechanically ventilated patients

Helman DL et al, Crit Care Med 2003



2.7 per 1000

Table 3. Rates of Catheter-Related Bloodstream Infection from Baseline (before Implementation of the Study Intervention) to 18 Months of Follow-up.*

Study Period	No. of ICUs	Overall	No.
Baseline	55	2.7 (0.6–4.8)	2.7
During implementation	96	1.6 (0–4.4)†	1.7
After implementation			
0–3 mo	96	0 (0–3.0)‡	1.3
4–6 mo	96	0 (0–2.7)‡	1.1
7–9 mo	95	0 (0–2.1)‡	0.8
10–12 mo	90	0 (0–1.9)‡	0
13–15 mo	85	0 (0–1.6)‡	0
16–18 mo	70	0 (0–2.4)‡	0

* Because the ICUs implemented the study intervention at different times.

Of the 103 participating ICUs, 48 did not contribute baseline data. P values were calculated by the two-sample Wilcoxon rank-sum test.

† P≤0.05 for the comparison with the baseline (preimplementation) period.

‡ P≤0.002 for the comparison with the baseline (preimplementation) period.

- Hand washing
- Full barrier precautions during insertion
- Desinfection
- Avoiding the femoral site
- Removing unnecessary catheters

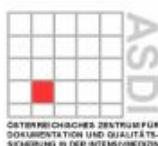
Pronovost P et al. N Engl J Med 2006;355:2725-2732





Qualitätsindikatoren für Intensivstationen

Version Oktober 2008



- Anwesenheit eines Intensivmediziners
- Frühe enterale Ernährung
- Milde, Therapeutische Hypothermie nach Reanimation
- Registrierung von kritischen Ereignissen
- Verzögerte Entlassung von der IBS
- Beatmungsassoziierte Pneumonie
- Durchschnittliche Dauer der mechanischen Beatmung
- Durchschnittliche Länge des Aufenthaltes an der IBS
- Infektionsrate Zentralvenöser Katheter
- Mortalität beim schweren Schädel Hirntrauma
- Reintubationsrate
- Standardisierte Mortalitätsrate
- Ungeplante Wiederaufnahmen



Foto: dpa

Association with
risk reduction of

-
- Routine check at shift change -32%
 - Critical incident reporting -31%

Intensive Care is a time-dependent process

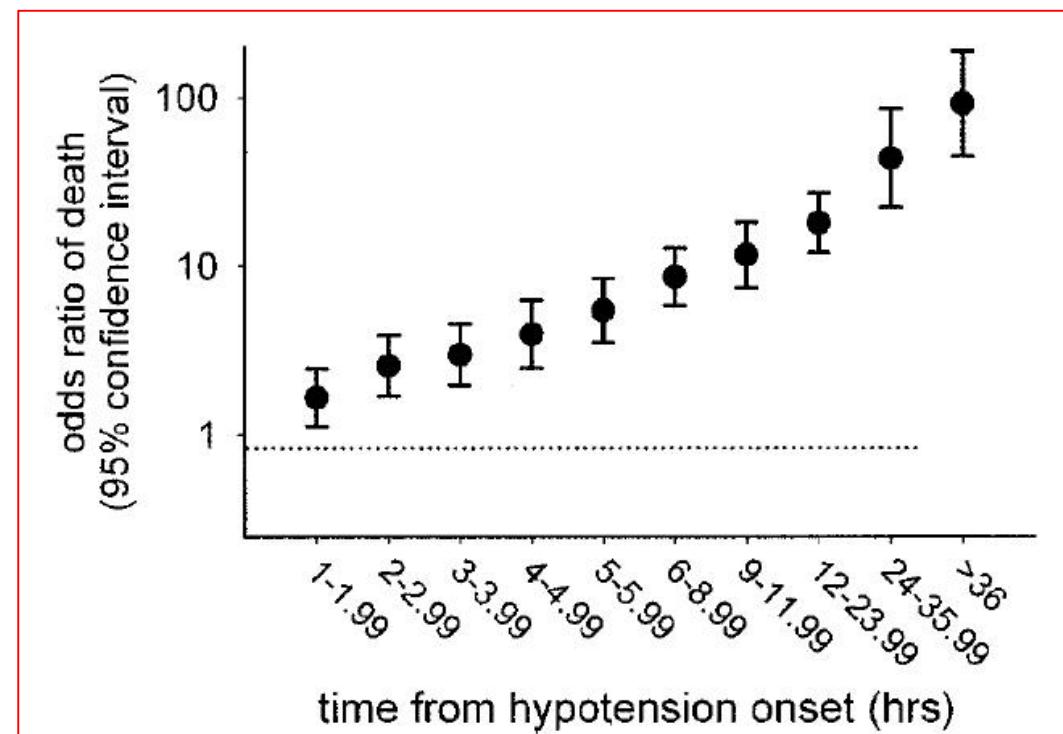


- Golden hour
- Early treatment
- Rapid Response
- Continuity
- 24h/7d

Duration of hypotension before initiation of effective antimicrobial therapy is the critical determinant of survival in human septic shock

Kumar A, Crit Care Med 2006

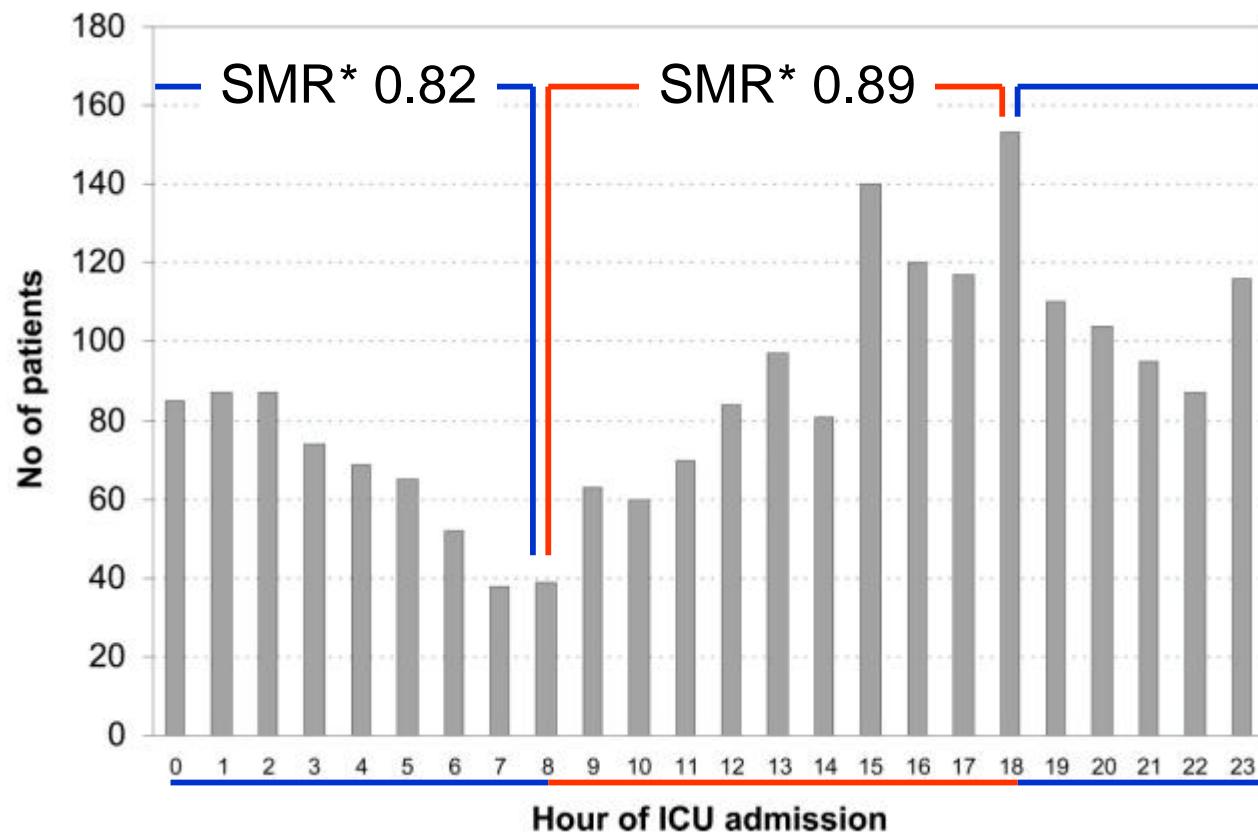
- 2.154 pts
- Septic shock
- Effective antimicrobial therapy only after the onset of recurrent or persistent hypotension



Only 50% of septic shock patients received effective antimicrobial therapy within 6 hrs of documented hypotension

24h/7d coverage by intensivists ensures consistency of care

* Calculated by MPM II₂₄



Electronic charting allows assessment of ICU response time

Blood glucose	Insulin dose change	Response time
215 mg/dl (02.08.2009 17:33)	+0,5 ml/h (02.08.09 18:17:00)	44 min
208 mg/dl (04.08.2009 21:23)	+0,5 ml/h (04.08.09 23:47:00)	144 min
192 mg/dl (10.08.2009 07:23)	+2,0 ml/h (10.08.09 07:34:24)	11 min
178 mg/dl (10.08.2009 06:03)	+0,5 ml/h (10.08.09 07:53:00)	110 min
187 mg/dl (10.08.2009 07:48)	+0,5 ml/h (10.08.09 07:53:00)	5 min
238 mg/dl (18.08.2009 08:54)	+0,3 ml/h (18.08.09 10:23:00)	89 min
152 mg/dl (19.08.2009 07:19)	+0,5 ml/h (19.08.09 07:27:51)	8 min
233 mg/dl (24.08.2009 06:14)	+0,5 ml/h (24.08.09 07:00:00)	46 min
190 mg/dl (31.08.2009 07:25)	+1,0 ml/h (31.08.09 07:36:32)	11 min
393 mg/dl (31.08.2009 01:55)	+0,5 ml/h (31.08.09 02:06:00)	11 min
249 mg/dl (31.08.2009 07:25)	+6,0 ml/h (31.08.09 07:37:13)	12 min
328 mg/dl (01.09.2009 03:03)	+4,0 ml/h (01.09.09 04:23:00)	80 min
246 mg/dl (01.09.2009 07:28)	+4,0 ml/h (01.09.09 07:38:35)	10 min
277 mg/dl (02.09.2009 09:49)	+0,5 ml/h (02.09.09 11:00:00)	71 min
339 mg/dl (02.09.2009 10:12)	+0,5 ml/h (02.09.09 11:00:00)	48 min

Schema Intensivaufenthalt

Merkmale

*Wer
Wann
Wohin*

Phase

Aufnahme Behandlung Entlassung

Struktur

+

+

+

Prozess

+

++

+

Ergebnis

+

+

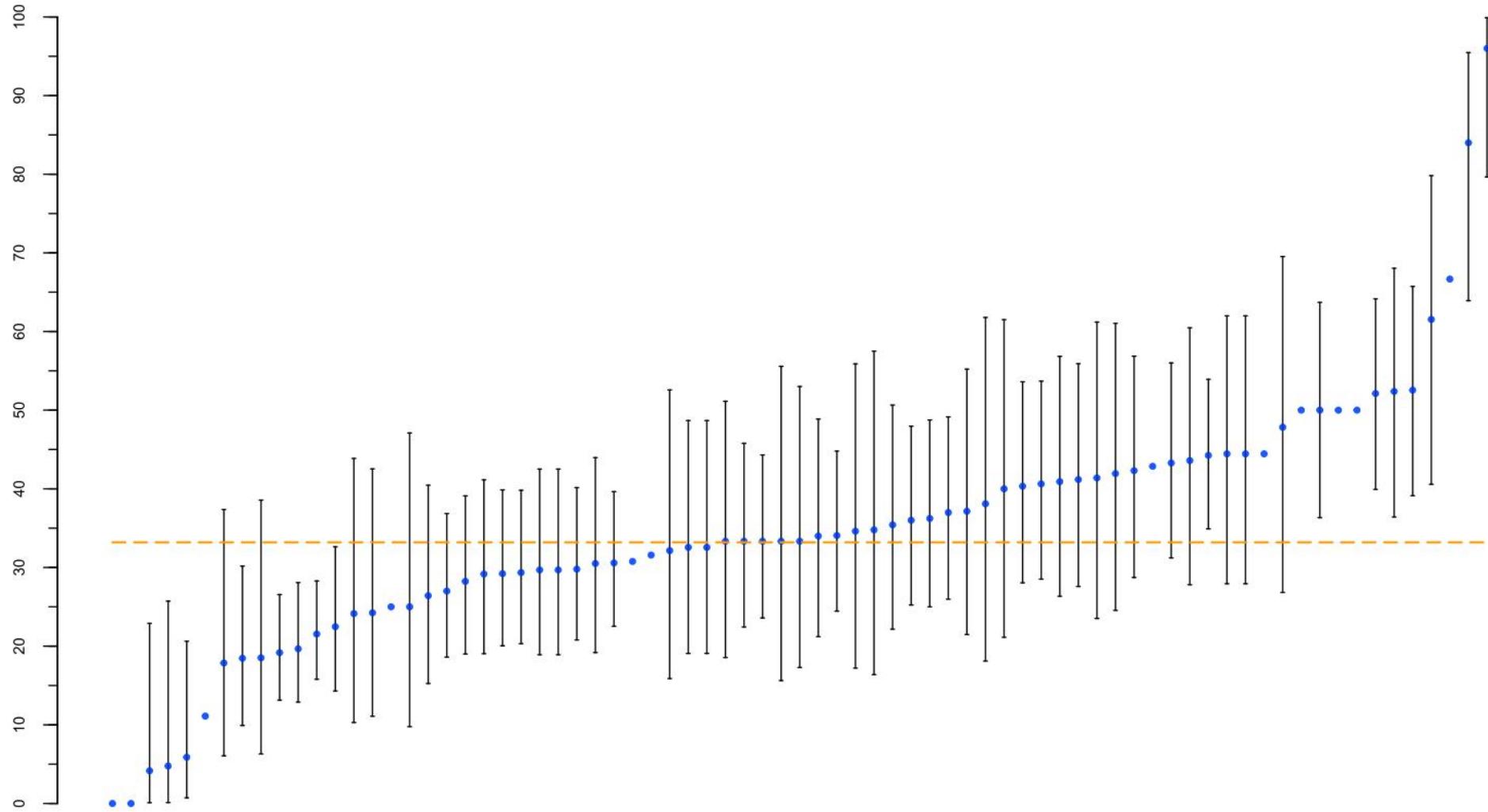
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Structure Measure	Process Measure	Outcome Measure
Intensivist-led ICU	Use of maximum sterile precautions for central venous catheter insertion	Catheter-related bloodstream infections ^a
Interdisciplinary rounds	Low tidal volume ventilation in acute respiratory distress syndrome	Ventilator-associated pneumonia
Optimal ICU patient monitoring	Measures (including head of bed elevation ^a) to prevent ventilator-associated pneumonia	Duration of mechanical ventilation
Information technology for outcome measurement	Protocol-driven weaning from mechanical ventilation	ICU-acquired upper gastrointestinal bleed
	Management of severe sepsis	ICU-acquired venous thromboembolism
	Use of stress ulcer prophylaxis	Risk-adjusted length of ICU stay ^b
	Use of venous thromboembolism prophylaxis	Risk-adjusted mortality ^b
	Early and adequate enteral nutrition	Actual patient pain scores
	Tight glycemic control	Family satisfaction with communication from healthcare providers
	Daily interruption of sedation	
	Appropriate transfusion thresholds	
	Timely, complete, and emotional communication with health and family members	
	Measurement of patient pain	

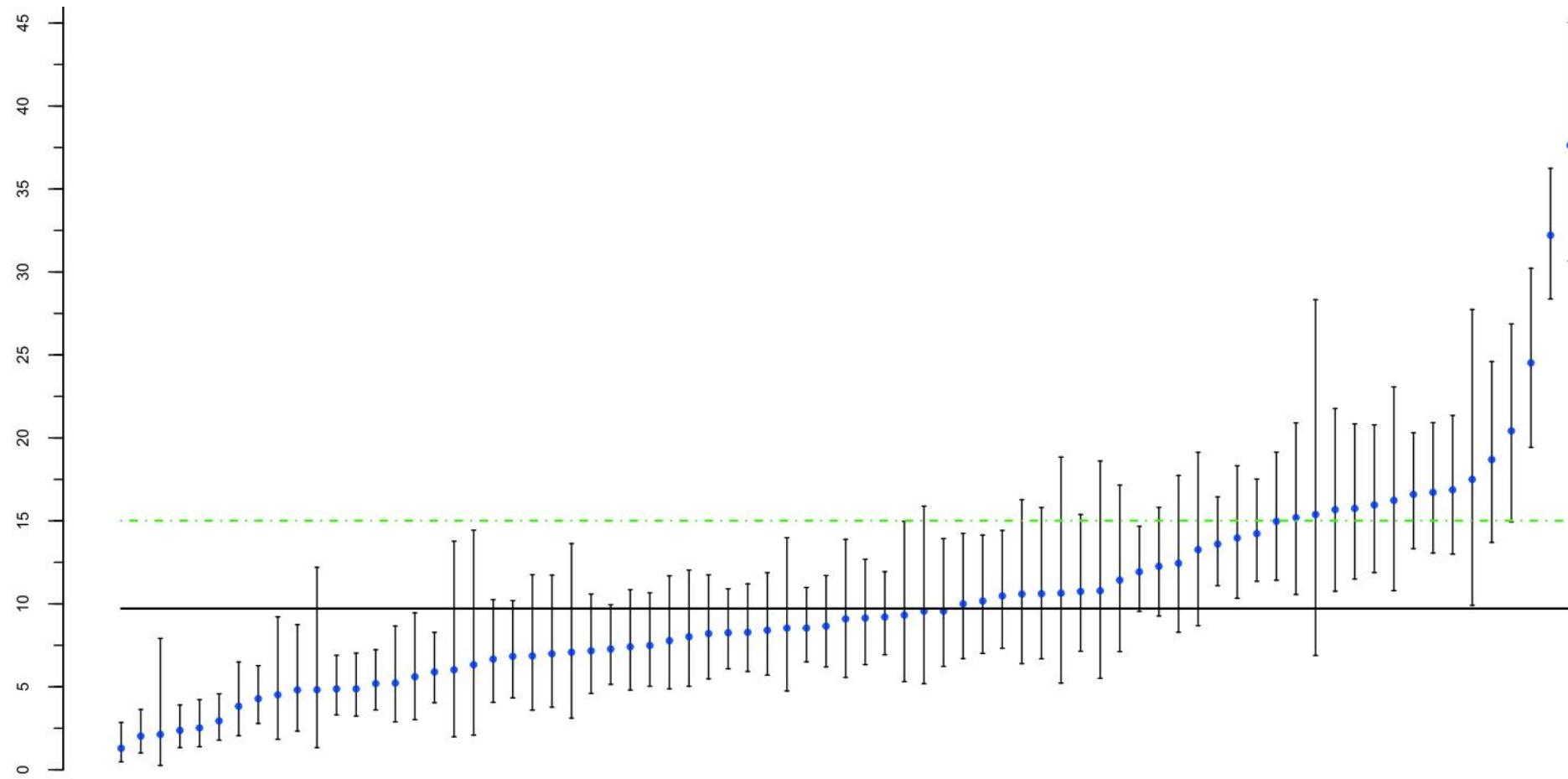
Post-ICU Mortality as % of Hospital Mortality

Author	Country	Post-ICU Mortality (%)
Bastos, 1966	Brasil	15
Rubins, 1988	USA	22
Moreno, 1997	Portugal	24
SAPS 3, 2005	SAPS 3	24.6
Smith, 1999	UK	25
Goldhill, 1998	UK	27
Valentin, ASDI, 2003	Austria	30
Moreno, 2001	EURICUS II	33
Rowan, 1993	UK	35

Relative Post-ICU Mortalität (% aller Todesfälle)



ICU-Entlassungen zur Nachtzeit (% aller Entlassungen)



Swiss survey of ICU discharge practices

Clinical Situation:

COPD, 48h postextubation, tracheal suctioning 6-8/day, PaO₂/FIO₂ = 200

Type of hospital	University Teaching		Central Referral		Community, Private	
	Yes	No	Yes	No	Yes	No
IMC available	78%	22%	30%	70%	23%	77%
Decision: Pt stays in the ICU	0%	0%	0%	29%	40%	39%

Heidegger C-P, Int Care Med 2005

Pts readmitted to the ICU have a more than fourfold risk of dying

Last ICU day

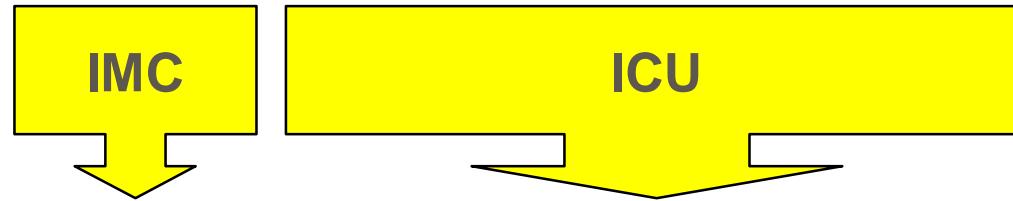
Risk factors for readmission

Variable	p value	Odds ratio	95% CI
Age	<0.001	1.08	1.03–1.14
Male sex	<0.001	1.36	1.17–1.59
Number of organ failures at first admission	<0.001	1.11	1.04–1.18
→ Supplementary ventilatory support (last ICU day)	<0.001	1.72	1.43–2.06
→ Mechanical ventilation (last ICU day)	<0.001	3.00	2.31–3.89
→ Multiple vasoactive medications (last ICU day)	0.020	1.33	1.05–1.70
→ Active diuresis (last ICU day)	0.007	1.28	1.07–1.52

Intermediate care reduced the mortality of pts discharged „prematurely“ from ICU

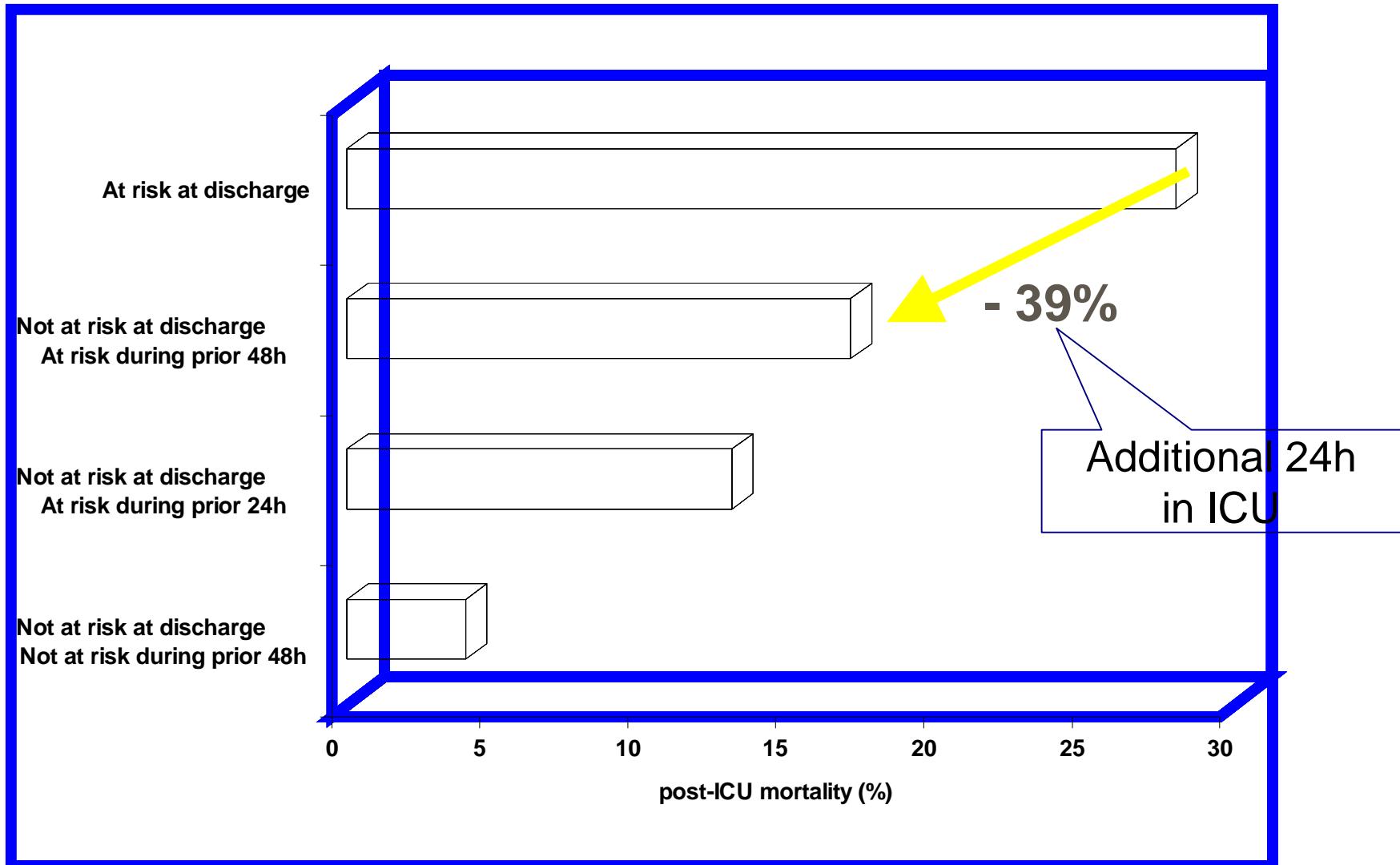
Beck DH, Intensive Care Med (2002)

	Severity adjusted	
	RR	95%CI
• Discharge at night:		
- All	1.70	1.28-2.25
- Ward	1.87	1.36-2.56
- HDU	1.35	0.77-2.36
• Discharge with TISS >30		
Ward vs HDU	1.31	1.02-1.83



Kriterien	Intensiv- überwa- chungs- einheiten	Intensivbehandlungseinheiten		
		Stufe I	Stufe II	Stufe III
Mittelwert der TISS-Punkte	keine	≥ 22	≥ 27	≥ 32
DGKP/system. Bett	$\geq 1,5:1$	$\geq 2,0:1$	$\geq 2,5:1$	$\geq 3,0:1$
Anerkennung durch die Landesgesundheitsplattform bzw. den PRIKRAF	ja	ja	ja	ja
Mindestbettenzahl, systemisiert	4	6	6	6
Korrekturfaktor	Auslastungsfaktor	ja	ja	ja
Verpflichtende Intensiv-Dokumentation	keine zusätzliche	TISS-28, SAPS, TRISS	TISS-28, SAPS, TRISS	TISS-28, SAPS, TRISS
Zusatz-Punkte pro Tag	322	504	721	1.153

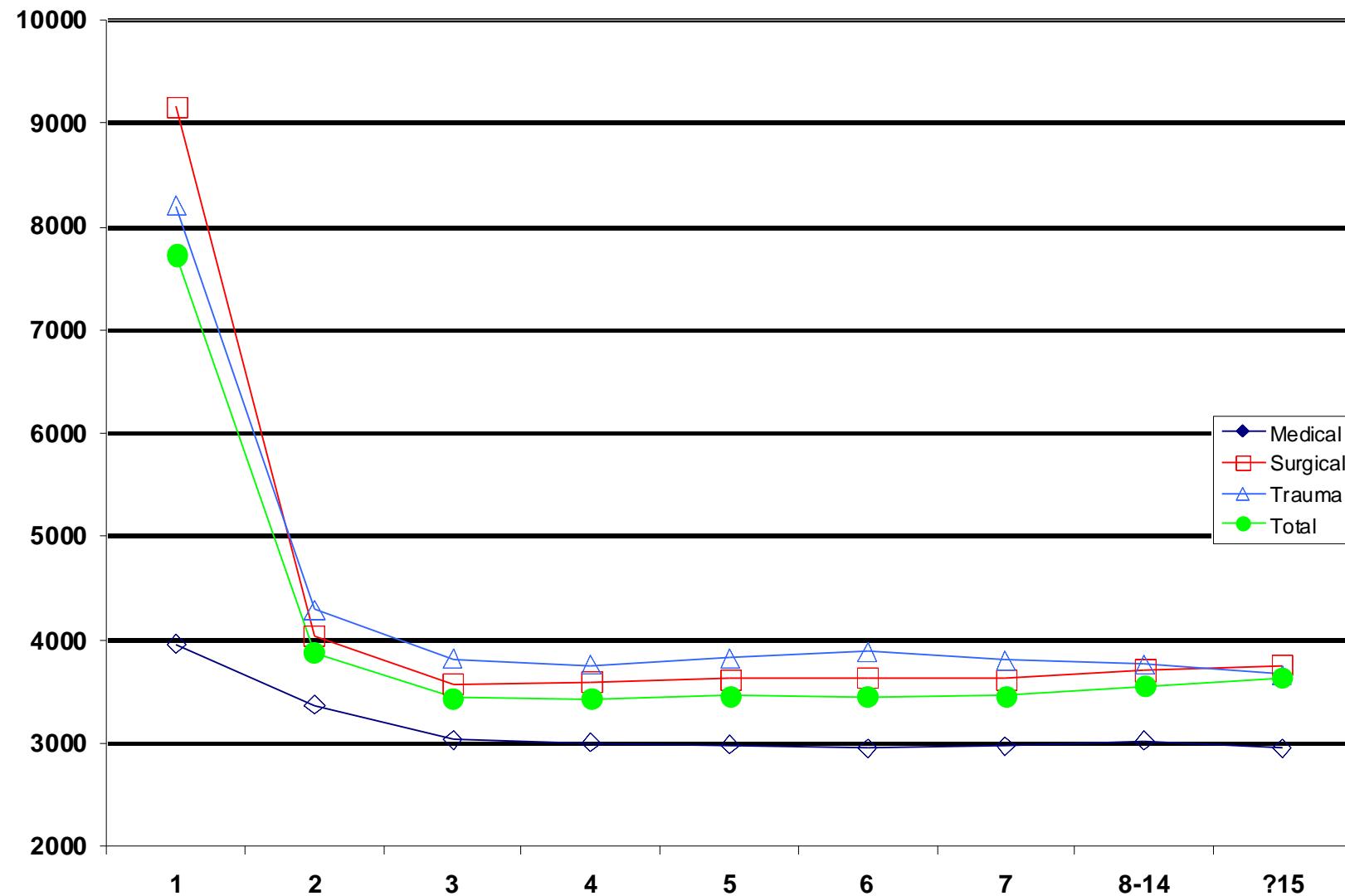
Predicted risk in subgroups and post-ICU mortality



Daly K, BMJ (2001)

Mean Daily ICU costs (\$)

Dasta JF, Crit Care Med 2005



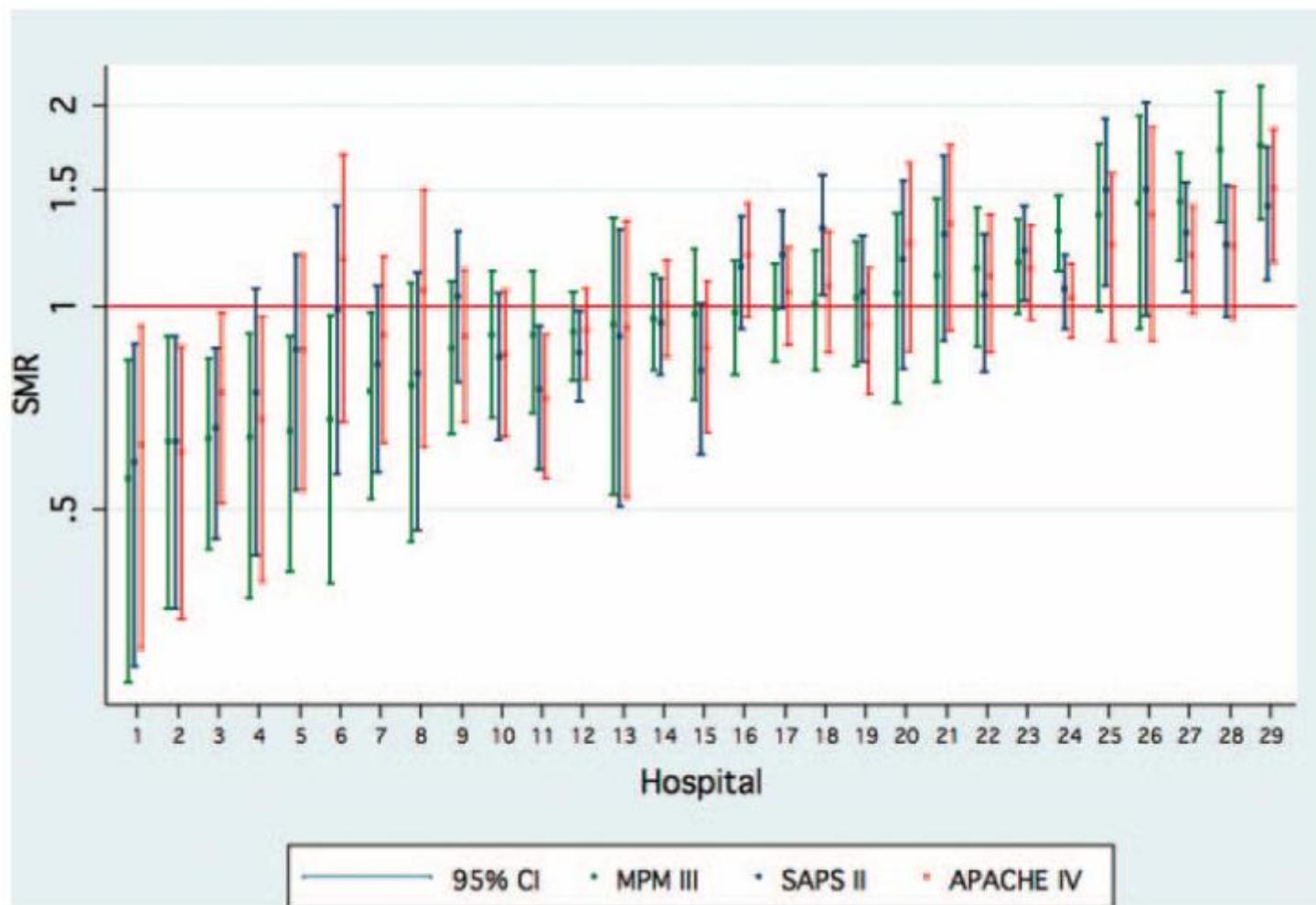
Was bedeutet ein zusätzlicher ICU Tag ?

Zusätzlicher ICU Tag	Zuwachs an Gesamtkosten (%)
Tag 2	33,3
Tag 3	22,8
Tag 4	19,5
Tag 5	15,8
Tag 7	12,0
Tag 14	6,6
Tag 21	4,6

Berechnung auf Datenbasis von Dasta, Crit Care Med 2006

Variation in ICU Risk-Adjusted Mortality

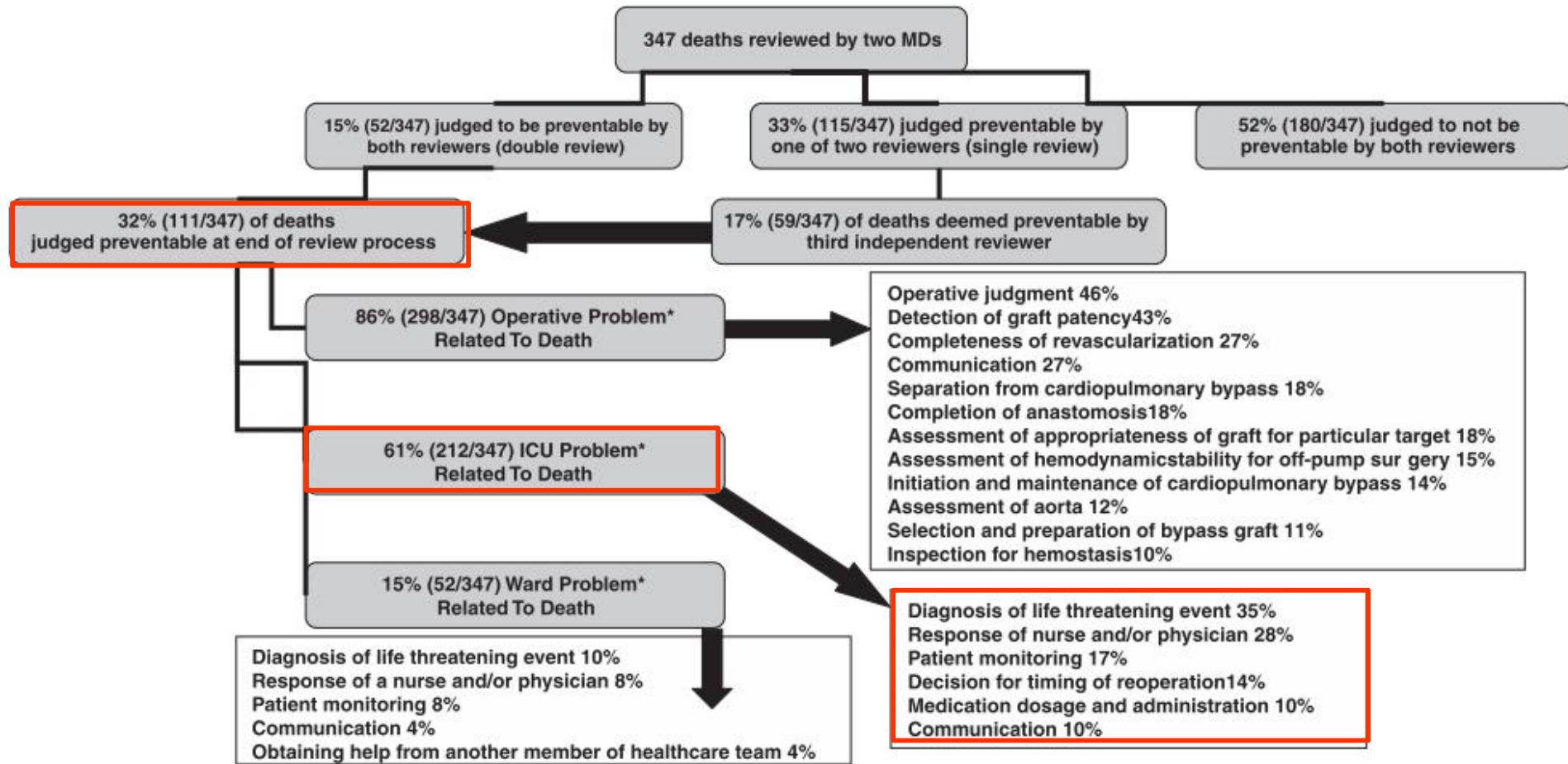
Kuzniewicz MW, Chest 2009



35 California hospitals

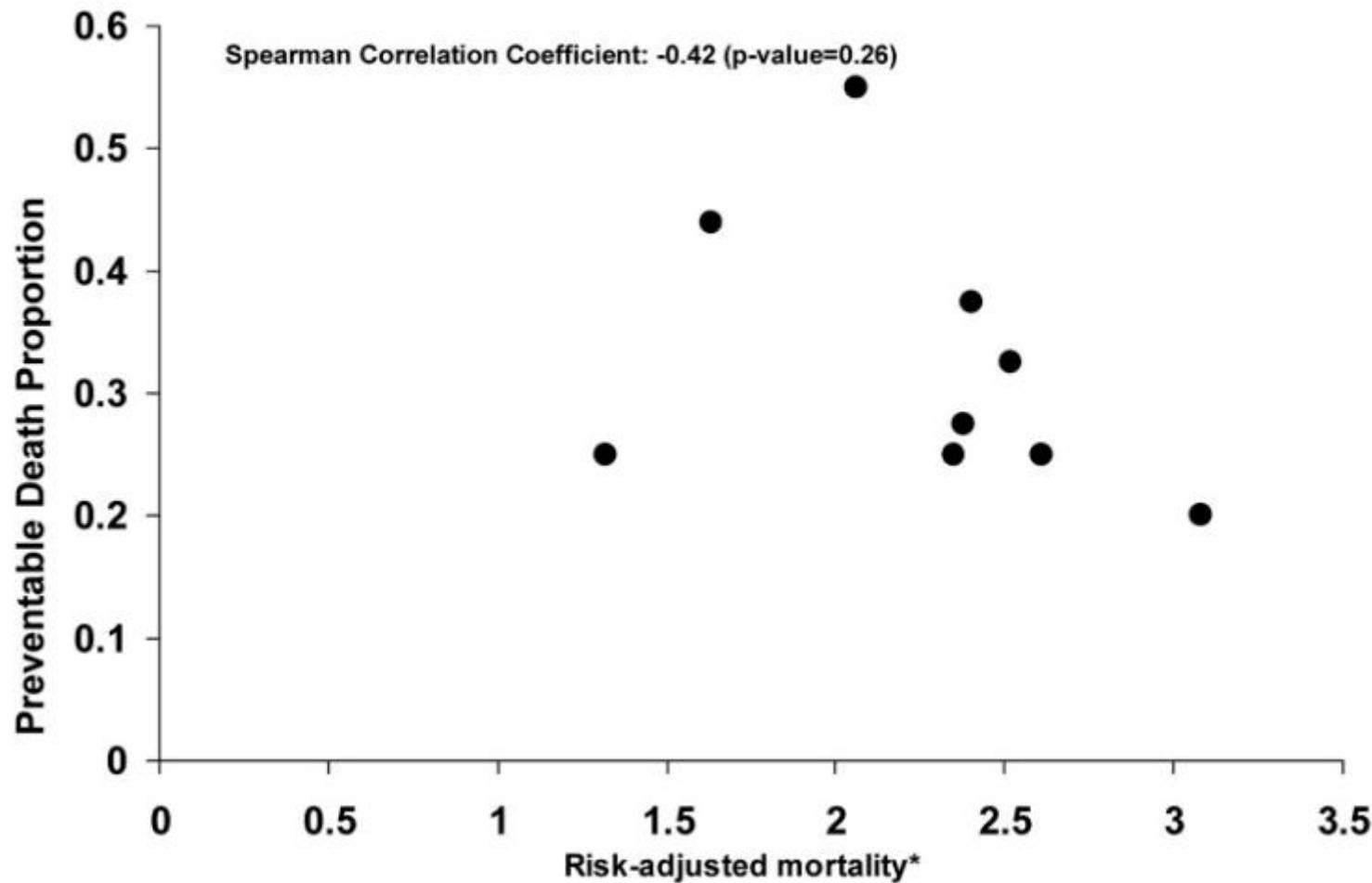
Preventable deaths after CABG surgery

Guru V, Circulation 2008



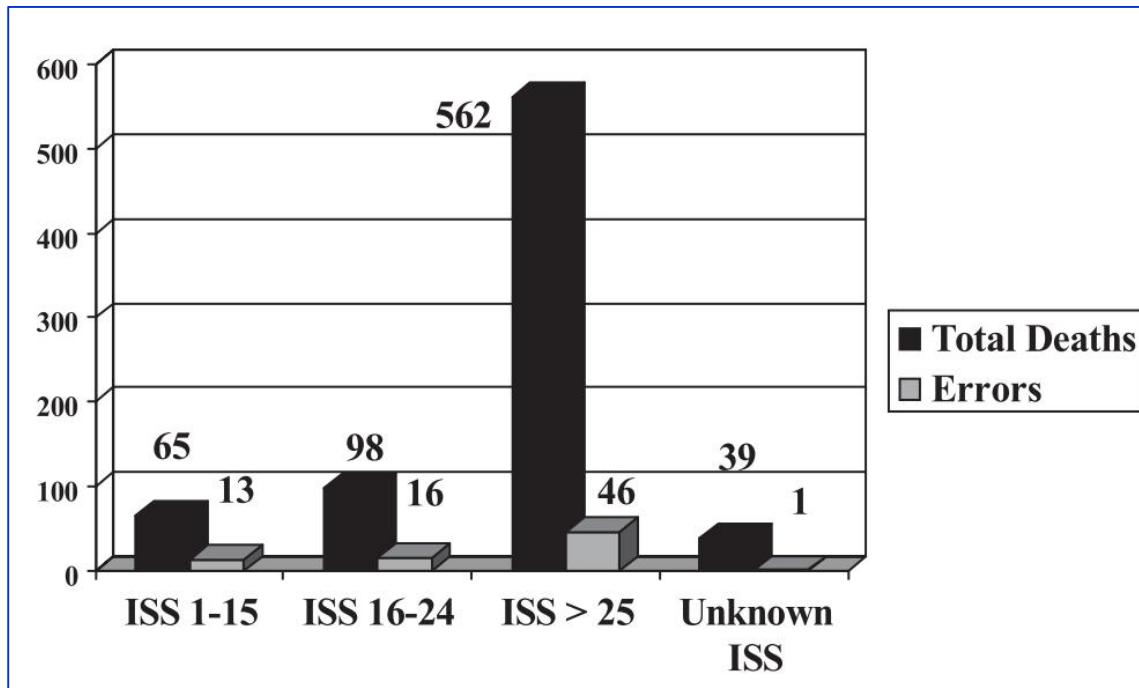
Preventable deaths after CABG surgery

Guru V, Circulation 2008



Patient safety in trauma: maximal impact management errors at a level I trauma center

Ivatury RR, J Trauma 2008



- Deaths 764
- Potentially preventable: 7.8%
- Preventable: 2.1%
- Human factors: 97%

Worüber müssen wir uns Gedanken machen ?

Merkmale

*Wer
Wann
Wo*

*Was
Wann
Wie lange*

*Wer
Wann
Wohin*

Phase

Aufnahme

Behandlung

Entlassung

Struktur

+

+

+

Prozess

+

++

+

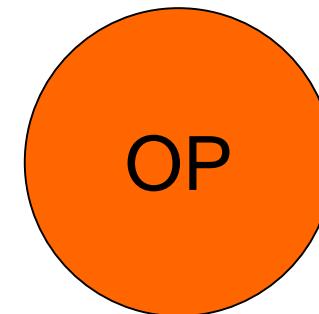
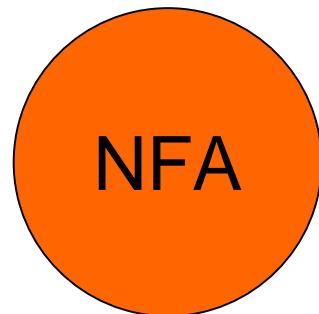
Ergebnis

+

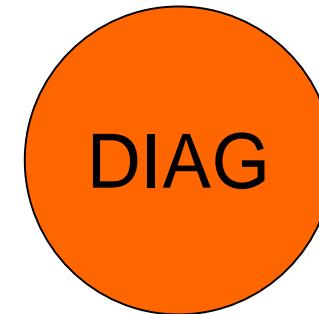
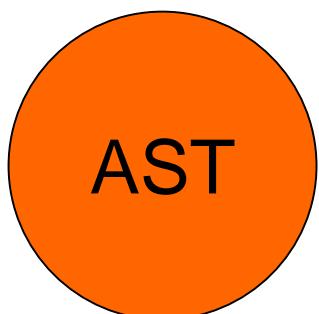
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Der Prozess Intensivmedizin



Intensivmedizin



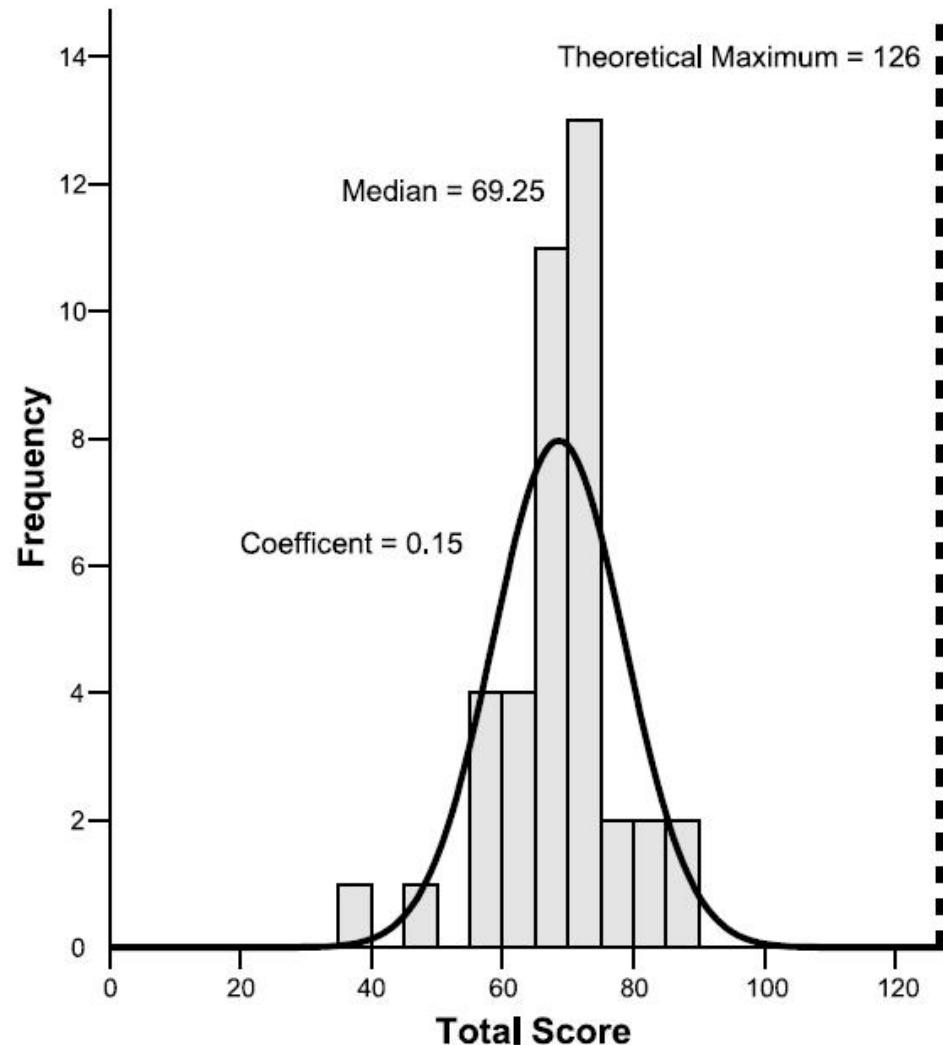
Qualitätsanspruch an das Gesundheitssystem

- Unabhängig von Zeitpunkt und Ort, sozialen Status, Geschlecht,.....
- Gewährleistung einer Behandlung
 - nach aktuellen Standards
 - zeitgerecht

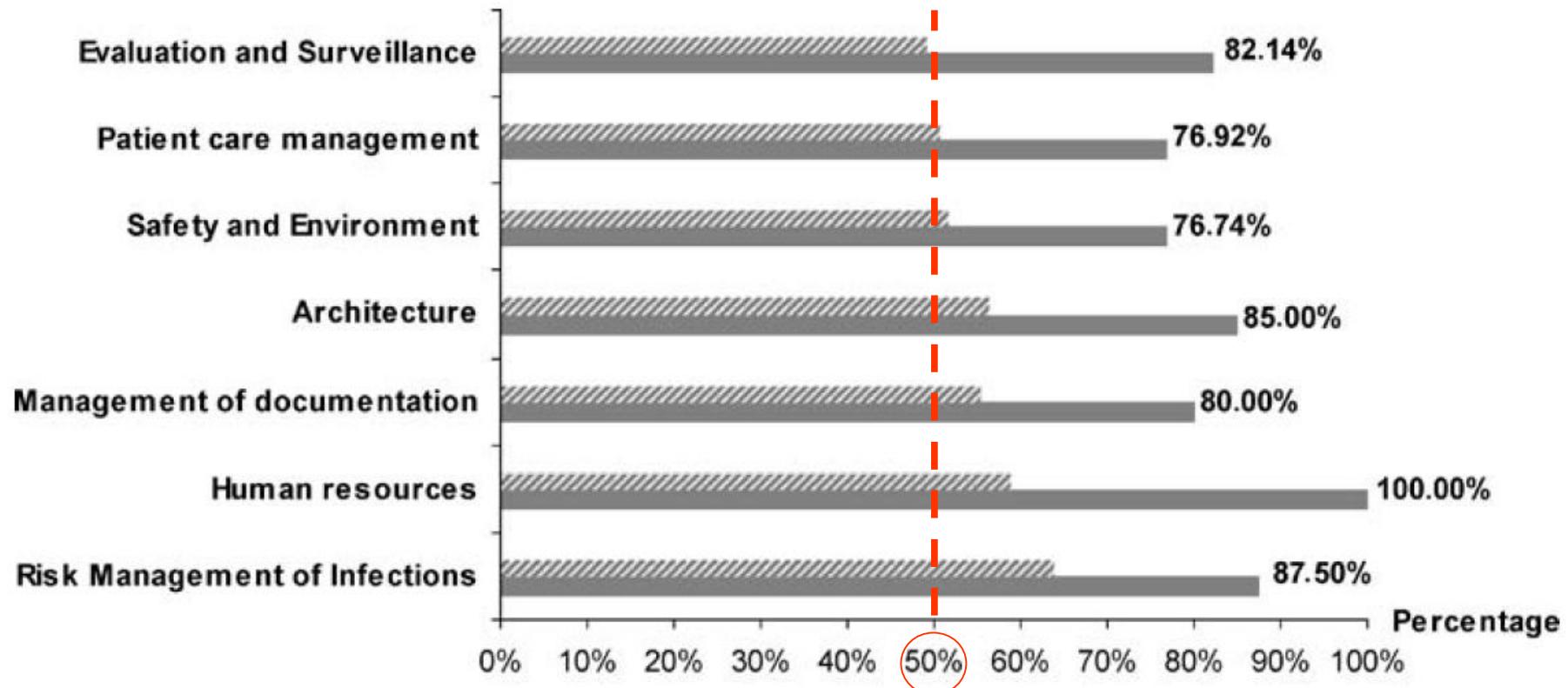
Quality assessment in ICUs: a proposal for a scoring system in terms of structure and process

Najjar-Pellet J et al, Int Care Med 2007

40 ICUs
95 Variables



Level of achievement



■ Average

■ Maximum

FAZIT

- Qualitätsindikatoren sind Ausdruck eines Anspruchs
- Realisierung setzt ädaquate Strukturen voraus
- Prozessindikatoren müssen als Ziel für das tägliche Tun wahrgenommen werden
- Outcomemessungen bedürfen einer sorgfältigen u. detaillierten Interpretation